Claims

1. Luminescence-conversion LED, an LED chip emitting primary radiation with a peak wavelength in the range of 300 to 470 nm, this radiation being converted partly or completely into secondary longer-wave radiation by photoluminescence by at least one phosphor which is exposed to the primary radiation of the LED, characterized in that the conversion is achieved at least with the assistance of a phosphor of a mean particle size d50 that lies in the range of 1 to 50 nm, preferably 2 to 25 nm, which is referred to hereafter as a nanophosphor.

2. The LED as claimed in claim 1, characterized in that the phosphor is dispersed in an encapsulating compound which is exposed to the primary radiation, the encapsulating compound consisting of insulating material.

3. The LED as claimed in claim 1, characterized in that a blue emitting primary radiation of a peak wavelength of 420 to 470 nm is used, together with a secondary yellow emitting phosphor.

4. The LED as claimed in claim 1, characterized in that a UV emitting primary radiation of a peak wavelength of 330 to 410 nm is used, together with three secondary red, green and blue emitting phosphors.

5. The LED as claimed in claim 4, characterized in that the following phosphor system is used: for red: Y2O2S:Eu; and for green: ZnS: Cu,Al or ZnS:Cu,Mn or ZnS:Cu; and for blue SCAP or ZnS:Ag.

6. The LED as claimed in claim 1, characterized in that the phosphor is chosen such that it has only low absorption in the range of the peak wavelength

of the primary radiation and is in particular a phosphor that is made to luminesce by an activator.

7. The LED as claimed in claim 6, characterized in that a nanophosphor is chosen such that an identical, but coarser-grained phosphor, which is referred to hereafter as a μm phosphor, exhibits at the peak wavelength of the LED chip a reflection of greater than 50% when a reflection measurement is carried out on a pressed powder tablet which consists of the μm phosphor and which is optically dense, that is to say has an angle-integrated transmission of < 5%, coarse-grained meaning that the mean particle size d50 is greater than 1 μm, in particular d50 is ≤ 20 μm, preferably d50 is ≤ 10 μm.

8. The LED as claimed in claim 6, characterized in that the long-wave absorption edge of the nanophosphor, which is described by the point A50, lies under the long-wave edge of the primary emission, described by the long-wave point FW 90, preferably FW 70, particularly preferably by FW 50, extremely preferably by the peak wavelength itself.

9. The LED as claimed in claim 7, characterized in that a nanophosphor with an activator is used, chosen such that the concentration of the activator is low, to be precise reaches at most 75%, preferably 10 to 50%, of the concentration of the activator in the case of the identical μm phosphor, so that the given activator concentration of the μm phosphor is higher and serves as a reference corresponding to 100%, the μm phosphor being chosen such that it has high absorption in the range of the peak wavelength of the primary radiation, preferably more than 50%, in particular more than 70%, but an identical phosphor with low concentration of the activator has low absorption

in the range of the peak wavelength of the primary radiation, preferably at most 30%, in particular at most 20%.

10. The LED as claimed in claim 1, characterized in that a single phosphor is used, comprising semiconducting nanoparticles, in particular CdSe.

11. The LED as claimed in claim 1, characterized in that the chip can be connected to a voltage source via electrically conductive terminals.

12. The LED as claimed in claim 11, characterized in that the voltage source provides a voltage of at most 5 V.

13. The LED as claimed in claim 9, characterized in that the nanophosphor is a garnet A3B5012 which is doped with a rare earth element D, the proportion of D being at most 0.9 mol % of A.

14. The production of LEDs with nanophosphors as claimed in one of the preceding claims, the phosphor being applied directly to the chip by means of CVR or CVD.

15. The production of LEDs with nanophosphors as claimed in one of the preceding claims, the phosphor being applied to the chip by means of printing, spraying or ink-jet.

16. The use of nanophosphors with a mean particle size d50 of 1 to 50 nm as a conversion means in optical semiconductor devices of the LUCOLED type for the conversion of short-wave primary emitting radiation between 300 and 470 nm into longer-wave radiation, in particular into visible radiation in the range of 430 to 750 nm.